the plurality of projectors with mutually overlapping regions existing between the images, a method comprising:

storing prescribed test images;

acquiring projected test images in which a prescribed test image is projected onto said projection screen respectively by each of said projectors;

calculating correction data for correcting the input images for the respective projectors, on the basis of the acquired test images, in such a manner that at least one of (A) a continuous brightness and (B) a uniform brightness is achieved across the whole projection area including the overlapping regions;

storing the correction data thus calculated; and

correcting the images input to the respective projectors, by using said correction data.--

REMARKS

In view of the foregoing amendments and the following remarks, the applicant respectfully submits that the pending claims are not anticipated under 35 U.S.C. § 102. Accordingly, it is believed that this application is in condition for allowance. **If, however, the Examiner believes that there are any unresolved issues, or believes that some or all of the claims are not in condition for allowance, the applicant respectfully requests that the Examiner contact the undersigned to schedule a telephone Examiner Interview before any further actions on the merits.**

The applicant will now address each of the issues raised in the outstanding Office Action.

Objections

Claim 6 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Since, however, rejected base claim 1 is allowable for at least the reasons described below, the applicant has not rewritten claim 6 at this time.

Rejections under 35 U.S.C. § 102

Claims 1-5 stand rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,222,593 ("the Higurashi patent"). The applicant respectfully requests that the Examiner reconsider and withdraw this ground of rejection in view of the following.

Independent claim 1 is not anticipated by the Higurashi patent because the Higurashi patent does not teach a correction data calculating section for calculating correction data for correcting input images for respective projectors, on the basis of the acquired test images, **such that a target brightness is achieved** across the whole projection area including overlapping regions. Independent 1 is reprinted below with this feature depicted in bold typeface:

> 1. An image projection and display device comprising:
>
> a plurality of projectors;
>
> a projection screen forming a focusing plane for projected images from the plurality of projectors, mutually overlapping regions existing between said images;

> a test image storing section for storing prescribed test images;
>
> an image capturing section for acquiring projected test images in which a prescribed test image is projected onto said projection screen respectively by each of said projectors;
>
> **a correction data calculating section for calculating correction data for correcting the input images for the respective projectors, on the basis of the acquired test images, in such a manner that a target brightness is achieved across the whole projection area including the overlapping regions;**
>
> a correction data storing section for storing the correction data thus calculated; and
>
> an image correcting section for correcting the images input to the respective projectors, by using said correction data. [Emphasis added.]

This feature and the Higurashi patent are discussed below.

Although the Higurashi patent is similar to the present invention in that it concerns correcting projected images making up a multiple-image display, it does not address correcting image data such that a target brightness (e.g., a uniform brightness or a continuous brightness) is achieved across the whole projection area including overlapping portions. Rather, the Higurashi patent is concerned with correcting for positional/alignment distortions (e.g., misalignment between a projector and the screen, and/or misalignments between projectors themselves), and also discusses correcting for distortion in a picked up image. These misalignments would otherwise result in "swung and tilted" images (See, e.g., column 4, lines 62-66.), or rotated and shifted images (See, e.g.,

column 7, lines 10-22.) Distortion in a picked up image may be the result of space-variant distortion in a camera lens. (See, e.g., column 9, line 57 through column 10, lines 3.)

The Examiner takes a portion of claim 7 out of context and contends it teaches that correction data for input images is determined such at that target brightness is achieved across the whole projection area, including overlapping portions. (See Paper No. 4, page 3.) More specifically, the portion of claim 7 cited by the Examiner states:

> when the image pickup means enlarges and picks up an overlapping portion of all images projected by the plurality of projectors, **the parameter calculating means accurately calculates the second parameter** on the basis of data on the partially enlarged image obtained by the image pickup means. [Emphasis added.]

Column 18, lines 13-18. In the Higurashi patent, claim 7 depends from claim 2 which depends from claim 1. Claim 1 specifies that the second parameter is, "for indicating a positional relationship between images projected on the screen by a plurality of projectors." Column 17, lines 6-8. As can be appreciated from the foregoing, the Higurashi patent does not operate at the Examiner contents. Accordingly, claim 1 is not anticipated by the Higurashi patent for at least this reason. Since claims 2-4 depend from claim 1 and since claim 5 depends from claim 4, these claims are similarly not anticipated by the Higurashi patent.

Although the Higurashi patent does discuss superimposing more than one image for use as a high brightness projector unit or multi-gradient projector unit (See, column 14, lines 18-21 and column 10, line 63-column 11, line 31.), this has nothing to do with calculating correction data for correcting the input images for the respective projectors, on the basis of the acquired test images, in such a manner that a target brightness is achieved across the whole projection area including the overlapping regions.

New claims

New claims 7-9 depend from claim 1, and new claims 11-13 depend from new claim 10. These new dependent claims further specify the test images stored. These claims are supported, for example, at page 11, lines 9 et seq.

New independent claim 10 is supported, for example, by Figures 1, 7 and 8 for example and the accompanying text.

New independent claim 14 is a method claim similar to apparatus claims 1 and 10.

Amendments to the Specification

The specification has been amended to correct a number of minor errors and to avoid the use of British English.

Conclusion

In view of the foregoing amendments and remarks, the applicant respectfully submits that the pending claims are in condition for allowance. Accordingly, the applicants request that the Examiner pass this application to issue.

Respectfully submitted,

May 27, 2003

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CERTIFICATE OF MAILING under 37 C.F.R. 1.8(a)

I hereby certify that this correspondence is being deposited on **May 27, 2003** with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

John C. Pokotylo

Reg. No. 36,242

SEPARATE SHEET WITH MARKED-UP VERSION OF CHANGES TO THE ABSTRACT IN ACCORDANCE WITH 37 CFR § 1.121(b)(2)(iii)

[The image]Image projection and display [device includes]devices include a plurality of projectors, a projection screen forming a focusing plane for the projected images from the plurality of projectors, mutually overlapping regions existing between the images, a test image storing section for storing prescribed test images, and an image capturing section for acquiring projected test images in which a prescribed test image is projected. The [device]devices further [includes]include a correction data calculating section for calculating correction data for correcting the input images for the respective projectors, on the basis of the acquired test images, in such a manner that a [target]uniform or continuous brightness is achieved across the whole projection area including the overlapping regions, a correction data storing section for storing the correction data thus calculated, and an image correcting section for correcting the images input to the respective projectors, by using the correction data.

SEPARATE SHEETS WITH MARKED-UP VERSION OF CHANGES TO THE SPECIFICATION IN ACCORDANCE WITH 37 CFR § 1.121(b)(2)(iii)

The paragraph starting at page 4, line 1 has been amended as follows:

In brief, [the]an image projection and display device according to the present invention comprises the following:

a plurality of projectors;

a projection screen forming a focusing plane for projected images from the plurality of projectors, mutually overlapping regions existing between the images;

a test image storing section for storing prescribed test images;

an image capturing section for acquiring projected test images wherein a prescribed test image is projected onto the projection screen respectively by each of the projectors;

a correction data calculating section for calculating correction data for correcting the input images for the respective projectors, on the basis of the acquired test images, in such a manner that a target brightness is achieved across the whole projection area including the overlapping regions;

a correction data storing section for storing the correction data thus calculated; and

an image correcting section for correcting the images input to the respective projectors, by using the correction data.

The paragraph starting at page 4, line 24 has been amended as follows:

[This]These objects and advantages of the present invention will become further apparent from the following detailed explanation.

The paragraph starting at page 7, line 15 has been amended as follows:

As illustrated in Fig. 2, this image projection system comprises, in general terms: a personal computer 1 forming an image generating section for generating fine image data; a controller section 2 for processing, dividing and outputting the fine image data from the personal computer 1 in accordance with a plurality of projectors used (in Fig. 2, four projectors), and also correcting the projected screen image on the basis of a captured image, with respect to each of the divided outputs, in such a manner that it achieves a target brightness across the whole projection area thereof including the superposed regions (overlapping regions); a plurality of projectors 3a - 3d; and an image [projection]capture section 5, such as a digital camera, or the like, for capturing a test image, or the like, projected on a screen 4. For the aforementioned projectors 3a - 3d, a liquid-crystal projector or DLP device (abbreviation for Digital Light Processing, a digital projection technique based on a DMD (Digital Micromirror Device), which is an optical semiconductor).

The paragraph starting at page 8, line 7 has been amended as follows:

In a composition of this kind, the fine image data created and output by the personal computer 1 is output to the controller section 2. The controller section 2 determines which portion of the fine image data is to be output to which of the respective [projector]projectors and it performs correction processing with respect to each projector image, by using correction data, in such a manner that a target image brightness is achieved across the whole projection area, including the overlapping regions. To obtain the required correction data, a test image is previously projected from the projectors onto the screen 4, that projected image is captured by means of an image information gathering camera 5, and the correction data is created on the basis of the captured image data. The method for calculating the correction data is described below.

The paragraph starting at page 10, line 1 has been amended as follows:

In the image projection and display device described here, it is supposed that the [colour]color differentials and gamma characteristics have previously been corrected between the respective projectors, whereupon the brightness of the projected images is corrected by the image correcting section 13 in such a manner that a target brightness is achieved over the whole projection area, including the overlapping regions.

The paragraph starting at page 10, line 8 has been amended as follows:

The corrected image data for each projector is converted to an [analogue]analog signal by a D/A converting section (not illustrated), and then supplied to the respective projector (3a - 3d) of the projector section 14. The respective projector images are then projected onto the screen 4 by the respective projectors (3a - 3d). The test image storing section 15 stores a test image which is a monotone image of a neutral grey or white tone, that is projected from the respective projectors. The aforementioned correction data is determined by projecting the test image read out from the aforementioned test image storing section 15 onto the screen 4, capturing the projected test image by means of an image capturing section 5, such as a digital camera, or the like, and then calculating correction values, in the correction data calculating section 16, for correcting the input images to each projector so as to achieve a target brightness in the whole projection area including the overlapping regions, on the basis of the captured image data. The calculated correction data is stored in the correction data storing section 17. A method for calculating the correction data in the correction data calculating section 16 is described hereinafter.

The paragraph starting at page 11, line 9 has been amended as follows:

The aforementioned test image storing section 15 stores a grey or white test screen for correcting the brightness of the whole projection area of the screen. However, provided that the respective R, G, B [colour]color differentials and gamma characteristics of the respective

projectors have already been corrected, then a [colour]color, such as R, G, or B may also be used as a test image. However, since it is considered that there will always remain some degree of difference between the R, G, B [colour]color characteristics of the projectors, it is desirable that grey or white light which contains all three [colours]colors, R, G, B, is used for correction. When using a light shield to perform approximate correction of the brightness of the overlapping regions, it is also necessary to store a test image comprising a black image for correcting the bias of the images produced by the projectors (even when a black input signal of level 0 is input, the projected images do not turn completely black, and their residual brightness (or "offset" amount) in this case is termed the "bias").

The paragraph starting at page 16, line 24 has been amended as follows:

In other words, a target value for the brightness across the whole screen area is set, and correction for achieving that target value is applied, [whilst]while the image actually projected onto the whole screen is captured, and hence it is possible to equalize any form of brightness irregularity across the whole screen area.

The paragraph starting at page 17, line 4 has been amended as follows:

Firstly, [(1)] a method for calculating correction data to achieve uniform brightness across the whole

projection area including the overlapping regions is described with reference to Fig. 6.

The paragraph starting at page 17, line 17 has been amended as follows:

In Fig. 6, the horizontal axis indicates the projection region on the screen 4, and the vertical axis indicates brightness (luminosity). Curve A is the luminosity change of projector 3a and curve B is the luminosity change of projector 3b. The respective luminosities of curves A, B indicate the reduction in the quantity of light in the overlapping region due to the effects of the light shields. Curve C indicates the measured brightness of the overlapping region. Furthermore, curve (e.g., line) H indicates a target brightness value, for achieving uniform brightness in the projection area. This target value H is, for example, an average value of the brightness calculated by the correction data calculating section 16 on the basis of image data for the whole projection area as acquired by the image information acquiring camera 5.

The paragraph starting at page 18, line 16 has been amended as follows:

Next, [(2)] a method for calculating correction data to achieve continuous brightness in the whole projection area including the overlapping regions is described with reference to Fig. 7.

The paragraph starting at page 23, line 22 has been amended as follows:

In the composition according to this second embodiment, since the method for calculating the correction data by projecting test images diverges from the method employed in the first embodiment, it is explained here with reference to the flowchart in Fig. 11, [centred]centered on the operation for creating correction data.

The paragraph starting at page 25, line 21 has been amended as follows:

As described above, by means of the image projection and display device according to the respective embodiments, in realizing a seamless large screen using a plurality of projectors, it is possible to make the [joins in]interfaces between the overlapping [regions]region and non-overlapping regions, as well as the overlapping regions themselves even less conspicuous, and hence a more seamless, finer and higher quality projected image can be achieved.

The paragraph starting at page 26, line 3 has been amended as follows:

In this invention, it is apparent that a wide range of different working modes can be formed on the basis of this invention without departing from the spirit and scope of the invention. This invention is not restricted by any specific embodiment [except being limited by the appended claims].